15.

Food, Eggs and Young of the Carnivorous Snail *Euglandina rosea* (Férussac).

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(Plate I).

The information contained herein is based on the observation of a single *Euglandina rosea* (Férussac) which was collected April 1, 1940, at Fort Myers, Florida, by Dr. William J. Hamilton, Jr., of Cornell University. On April 11 the snail was placed in a terrarium filled with humus and soil, at Ithaca, New York. Standing water was provided to keep the air in the container moist. The individual successfully survived until December 9, 1940, when accidental overheating caused its death. During the interval of 252 days observations concerning its food habits, eggs and young were carried out.

Food of *Euglandina.*

During this period of approximately 8 months the following New York land mollusks were placed in the terrarium with the carnivorous *Euglandina:* one *Mesomphix inornatus* (Say), two *Mesomphix cupreus* (Rafinesque), six *Anguispira alternata* (Say), and four newly hatched and two adults of *Triodopsis albolabris* (Say). Of these species only the *M. inornatus,* and the six *A. alternata* were devoured; the remaining snails were left untouched.

The *Euglandina* was observed during its process of feeding upon the *M. inornatus.* The predatory snail in approaching the *M. inornatus* lifted its head and anterior foot region in the air and moved them from side to side. This weaving back and forth continued for 60 seconds; during this time the greatly elongate lips were moved from side to side. Finally the *Euglandina* touched the body of the food snail, whereupon the latter contracted into its shell. The *Euglandina* then employed its anterior foot region to turn the *Mesomphix* shell over on its spire. This done, the predator entered the aperture of the food snail's shell; the posterior foot region serving to hold the rest of the body firmly to the substratum. As soon as the *Euglandina* thrust its head into the *Mesomphix* shell aperture it began to feed with a piston-like motion, apparently forcing its head firmly against the soft parts of the prey so that the radula could obtain a firm purchase. The piston motion was accompanied by a lateral movement, indicating that the *Euglandina* was working from the columellar region outward, and then back again. Because of the thinness of the *M. inornatus* shell, the feeding could be observed without great difficulty. As the body of *Mesomphix* was gradually consumed the *Euglandina* worked further into the prey's shell, until its shell presented an effective block against further entrance. During the preliminary feeding the tentacle-like lips seemed to be thrust between the body of *Mesomphix* and its shell. Finally the columellar muscle of the *Mesomphix* was torn loose and the entire upper visceral mass was observed to disappear into the buccal cavity of the *Euglandina.* The feeding process took 40 minutes from the time of entrance until all of the body of *Mesomphix* had disappeared.

After the soft parts had been consumed the lips of the *Euglandina* were observed to move about the interior of the shell as though the animal was searching for food fragments which might have been overlooked. It seems likely that the sense of smell is well-developed in *Euglandina* and possibly serves this animal in locating food. Simpson's data (1901) indicates that the sense of smell is highly developed and used to locate food by *Triodopsis albolabris* (Say). He records this species moving 18

inches in order to feed on concealed lettuce. When the *Mesomphix* was placed in the terrarium with the carnivore, the latter was 10 inches removed and was fully contracted within its shell. In 3 minutes the *Euglandina* was active, and was moving toward the *Mesomphix*. A similar phenomenon was observed when one *A. alternata* was placed in the terrarium; the *Euglandina* was again contracted and motionless, 6 inches away from the *Anguispira*. In five minutes it became active and moved toward the food snail.

The six *A. alternata* and the one *M. inornatus* utilized as food were all turned over on their apices before they were devoured.

The following writers have discussed the snail food of *Euglandina rosea*. Baker (1903) reports *Euglandina* feeding upon the large Floridan pulmonate mollusks of the genera *Liguus* and *Orthalicus*. He observed that in some instances the voracious *Euglandina* will even bore a hole in the shell of the victim in order to reach the animal, instead of entering through the prey's aperture. Rogers (1908) states that *Euglandina* devours individuals of its own species and preys chiefly upon Helices. A. Binney (1851) reports *Euglandina* feeding on half-putrid remains of a *Helix*, and on Limacies which were confined together in the same container. He, too, writes that it preys on its own kind. W. G. Binney (1885) concerning the feeding habits of *E. rosea* states, "By its [the radula's] action the soft parts of its prey are rapidly rasped away or are forced in large morsels down the oesophagus. The animal has been seen to swallow entire the half-putrid remains of a *Helix*, and to attack *Limaces* confined in the same box with it, rasping off large portions of the integument, and in some instances destroying them. In one instance an individual attacked and devoured one of its own species, thrusting its long neck into the interior of the shell and removing all the viscera. I found many specimens of *Polygra volvoxis*, [*Polygra septemvolva* Say], in the stomach of individuals collected by me at Saint Augustine, Fla."

Eggs of *Euglandina*.

In the second week of October the *Euglandina* deposited 22 eggs on the upper surface of the humus in the terrarium. This location was exposed to light, although more secretive places were available. Five of the eggs did not hatch. Because of periodic absence from the laboratory complete data on the incubation period were not obtained. The approximate incubation period was 60 to 68 days; the hatching period for individuals continued for 8 days after the first individual had emerged, 60 days after the egg had been laid.

The oval-oblong eggs were of nearly uniform size, measuring 4.25 mm. in length and from 3 to 3.25 mm. in width (Fig. 1). The egg shell is brittle and hard; no inner egg membrane is present. The egg shell is extremely rough, and is quite porous.

Young of *Euglandina*.

The young develop with their long axes coinciding with the long axis of the egg. The young break through the egg shell by means of the radula. A circular opening (Fig. 1) is first filed in the egg shell at the end surrounding the aperture of the young within. The initial hole is enlarged by use of the radula until approximately one-third of the egg shell is cut away (Fig. 2). This done, the young emerges, leaving an intact two-thirds of the shell behind. The exact amount of time required for the young to cut away enough shell to permit their escape was not observed. It is estimated, however, that with the young in question it was between 6 and 10 hours.

Little variation in size is shown in newly hatched young; of 15 that were measured the length varied .25 mm.; with the greatest length 4 mm., and the least 3.75 mm. Variation in width was also .25 mm.; the widest shell was 3 mm.; and the narrowest 2.75 mm. The largest young was 3.90 mm. in length and 2.90 mm. in width; the smallest was 3.75 mm. long and 2.75 mm. wide.

Each young has approximately two and one-fourth shell whorls upon hatching, as compared to the 6 to 8 whorls of fully mature shells. The aperture of the young is relatively large in proportion to the length of the shell, running approximately five-sevenths of the total shell length (Fig. 3). In the parent of these young the aperture was approximately equal to one-half of the total shell length. W. G. Binney (1885) concerning the length of young shells that he studied states, "In young individuals the spire forms but a small proportion of the shell, but in the old it often forms one-third of the length." A Binney (1851) comments on the shortness of the spire of young individuals, and at its enormous increase in mature shells. In an attempt to supply food for the young snails 4 small immature *T. albolabris* were placed within reach. Adult individuals of *A. alternata* were also available but individuals of neither species were touched. Apparently the lack of suitable animal food resulted in the death of the young 15 days after hatching.

Natural Habitat of *Euglandina*.

It should be understood that the observations included here were made in a habitat far from that in which *Euglandina rosea* is found. The data are, however, the most extensive to be reported on the eggs and young of *Euglandina*, and the photographic method

has not been used before to illustrate the eggs and young of this species.

The natural habitat is reported by W. G. Binney (1885) as follows, "The habits of this animal are somewhat aquatic. It is found on the sea islands of Georgia and around the keys and everglades of Florida, and in these situations the shell often attains the length of 4 inches; when found on the oyster hummocks and less humid localities it seldom exceeds 1 inch in length. Mr. Say found it in the marshes immediately behind the sand-hills of the coast. It is most readily found in the center of the clumps of coarse grass on these marshes." W. G. Binney (1885) lists the following distribution: Atlantic and Gulf States from North Carolina to Texas; Macon Springs, Georgia; Bibb County, Alabama; and Jackson, Mississippi. A. Binney (1851) indicates that it is common among the West Indian Islands. Pratt (1935) states that its distribution is from South Carolina to Texas.

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EXPLANATION OF THE PLATE.

Fig. 1. Egg of *Euglandina rosea*, showing initial opening cut by radula of young within its eggshell. Note porous and rough character of the shell. × 21.

Fig. 2. Egg of young three hours later, showing egg shell cut away, revealing the immature snail within. × 23.

Fig. 3. Newly hatched young which emerged approximately 6 hours after the initial opening had been made in the egg shell. × 23.